In the problems which follow, assume that the \( xy \)-plane is made of rigid, massless, transparent stuff.

1. For positive integers \( n \), let \( P_n \) denote a \( y \)-axis point:

\[
P_n = (0, 2^n),
\]

where the coordinates are assumed to be measured in meters.

Furthermore, for each \( n \), assume that a mass of \( 3^{-n} \text{ kg} \) is concentrated at \( P_n \).

(a) Compute the total mass of this array.

(b) Find the balance point of this array. That is, compute its center of mass.

2. Repeat problem 1 for the situation where we move all the points \( P_n \) to new positions: for positive-integer \( n \),

\[
P_n = (0, 3^n).
\]

3. Repeat problem 1 for the situation where we move all the points \( P_n \) yet again to new positions: for positive-integer \( n \),

\[
P_n = (0, \sqrt{n} + 3).
\]

Assume also that, for positive-integer \( n \), a mass of \( \frac{1}{n^2 - n + 1} \text{ kg} \) is concentrated at point \( P_n \).

(a) Does this array have a finite mass?

(b) Does this array have a balance point?

4. This problem is for folks who’ve worked on 11.9: 38. Here’s a partial answer key for that problem:

- 38 (b) (ii): 2
- 38 (c) (ii): 4
- 38 (c) (iii): 6

Answer the problem 1 questions for the case that for all positive-integer \( n \) we have a mass of \( n3^{-n} \text{ kg} \) concentrated at \( P_n = (0, 2^n) \).